

See "Instructions for Filling out the Work Permit" contained in the Work Planning and Control for Experiments and Operations Subject Area.

1. Work request WCC fills out this section.
☐ Standing Work Permit

Requester: Don Lynch	Date: 6/27/2014	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 7/7/2014	Est. End Date: 11/30/2014
Brief Description of Work: Mechanical assembly and Installation of MPC-Ex Detector subsystem (North and South)			
Building: 1008	Room: IR	Equipment: MPC-Ex	Service Provider: PHENIX technicians and MPC-Ex experts

2. WCC, Requester/Designee, Service Provider, and ESS&H (as necessary) fill out this section or attach analysis

ESS&H ANALYSIS			
Radiation Concerns	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne
	<input type="checkbox"/> Contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> NORM
	<input type="checkbox"/> Other		
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group		<input type="checkbox"/> Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer	
Radiation Generating Devices:	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges
	<input type="checkbox"/> X-ray Equipment		
Safety and Security Concerns	<input type="checkbox"/> None	<input type="checkbox"/> Explosives	<input type="checkbox"/> Transport of Haz/Rad Material
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Critical Lift	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Magnetic Fields*
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Nanomaterials/particles*
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Noise*
<input type="checkbox"/> Biohazard*	<input checked="" type="checkbox"/> Elevated Work	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Non-ionizing Radiation*
<input type="checkbox"/> Chemicals/Corrosives*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lead*	<input type="checkbox"/> Oxygen Deficiency*
<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Ergonomics*	<input checked="" type="checkbox"/> Material Handling	<input type="checkbox"/> Penetrating Fire Walls
<input type="checkbox"/> Vacuum	<input type="checkbox"/> Other: work near beampipe		
* Safety Health Rep. Review Required <input type="checkbox"/> Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM			
Environmental Concerns	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.	
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input type="checkbox"/> Land Use Institutional Controls	<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Liquid Discharges	<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Oil/PCB Management	<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Spill potential	<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping
Waste disposition by: <input type="checkbox"/> Other			
Pollution Prevention (P2)/Waste Minimization Opportunity:	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes	
FACILITY CONCERNS	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Intermittent Energy Release	
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise	<input type="checkbox"/> Potential to Cause a False Alarm	<input type="checkbox"/> Vibrations
	<input type="checkbox"/> Impacts Facility Use Agreement	<input type="checkbox"/> Temperature Change	<input type="checkbox"/> Other
<input type="checkbox"/> Configuration Management	<input type="checkbox"/> Maintenance Work on Ventilation Systems	<input type="checkbox"/> Utility Interruptions	
WORK CONTROLS			
Work Practices			
<input type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input checked="" type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment
<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input checked="" type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")
			<input type="checkbox"/> Electrical Inspection Required
Personal Protective Equipment			
<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input checked="" type="checkbox"/> Gloves as appropriate	<input type="checkbox"/> Lab Coat
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator*
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety Shoes as appropriate
		<input type="checkbox"/> Shoe Covers	<input type="checkbox"/> High visibility cloths/vest
<input type="checkbox"/> Other			
Permits Required (Permits must be valid when job is scheduled.)			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems	
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No	
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other	
Dosimetry/Monitoring			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input type="checkbox"/> TLD
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O ₂ /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump	
Training Requirements (List specific training requirements)			
PHENIX Awareness, CA Access or Equiv. Scaffold Training,			
Based on analysis above, the Review Team determines the risk, complexity, and coordination ratings below:		If using the permit when all hazard ratings are low, only the following need to sign: (Although allowed, there is no need to use back of form)	
ESS&H Risk Level:	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High
Complexity Level:	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High
Work Coordination:	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High
		WCC:	Date:
		Service Provider:	Date:
		Authorization to start	Date:
(Department/Division, or their equivalent, Sup/WCC/Designee)			

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

Work Plan (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail): See attached Procedure.

Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring)

None

Notifications to operations and Operational Limits Requirements: None

Post Work Testing, Notification or Documentation Required:

Job Safety Analysis Required: ☐ Yes ☒ No

Review Done: ☒ in series ☐ team

Reviewed by: * Primary Reviewer signature means that the Review Team members were appropriate for the work that was planned, the Team visited the job site, hazards and risks that could impact ESS&H have been considered and controls established according to BNL requirements. In addition, this signature indicates that applicable JRAs, FRAs, as well as other planning documents have been reviewed and training requirements have been identified and recorded on this permit.

Title	Name (print)	Signature	Life #	Date
ES&H Professional				
F&O Facility Project Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Safety Health Representative				
Research Space Manager				
Other				
Other (PHENIX Escort)				
Required Walkdown Completed				
*Primary Reviewer				

4. Job site personnel (Supervisor and workers) fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments) and all training required for this permit is current/complete. Job Supervisor/Contractor Supervisor signatures also includes verification that worker training required for this permit is current/complete.

Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:

Workers are encouraged to provide feedback on ESS&H concerns or on ideas for improved job work flow. Use feedback form or space below.

5. Department/Division, or their equivalent, Line Manager or Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)

Name:	Signature:	Life#:	Date:
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6. Worker provides feedback.

Worker Feedback (use attached sheets as necessary)

a) WCM/WCC: Are there any changes as a result of worker feedback? ☐ Yes ☐ No

Note: See Work Planning and Control for Experiments and Operations Subject Area section 2.6.

7. Post Job Review/Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of job site to work supervisor.) The WCC ensures that the change process to update drawings, placards, postings, procedures, etc., is initiated, if necessary.

Name:	Signature:	Life#:	Date:
Comments:			

MPC-Ex

Introduction

The Muon Piston Calorimeter (MPC) Extension, or MPC-EX, is a Si-W preshower detector that will be installed in front of the existing PHENIX MPC's in both the north and the south Muon Magnets. This detector consists of eight layers of Si "minipad" sensors interleaved with tungsten absorber and enables the identification and reconstruction of π^0 mesons at energies up to ~ 80 GeV.

The PHENIX Collaboration will install this new detector subsystem during the 2014 summer shutdown to be fully ready for service for run 15. An engineering run consisting of a partial detector installed in the south Muon Magnet piston hole was successfully implemented for run 14, proving and qualifying the detector installation techniques and operational characteristics. This document describes the work plan to assemble and install the full complement of 2 stations (north and south) for the detector.

MPC-Ex Design

(Please see the attached Assembly and Installation Plan for illustrations of the following design, assembly and installation descriptions.)

The MPC-Ex design consists of 8 layers (plates) of 2.0 mm thick tungsten spaced 4.5 mm apart. There are upper and lower halves to the MPC-Ex and north and south stations in the north and south Muon Magnets, respectively. On to each tungsten plate a carrier board is adhered. To each carrier board 12 micromodules consisting of a minipad silicon sensor sandwiched and glued between a ceramic base and a Dual SVX-4 Readout Card. The card is then wirebonded to the silicon sensor. On the side farthest from the PHENIX IP, a Delrin plate will be attached provide a light tight closure beyond the last layer of carrier board.

Assembly of the MPC-Ex detectors requires gluing fixtures for the micromodules and for the carrier board/tungsten plate lamination.

The 8 layers are stacked up and spaced using threaded rods and threaded spacers, then the upper and lower ends are capped with support covers. Low voltage distribution boards are mechanically attached to the upper and lower support covers. Each Carrier board has power connections between itself and the LV distribution board and bias voltage connections. The LV distribution boards have power and communication cables to a control racks mounted on the north and south MuTrigger racks.

In addition, each carrier board has 2 ribbon cable pig tails which connect via a 2 meter ribbon cable to a front end module. The front end module in turn connects back to the

control rack via flat LVDS cable. Communication from the rack room to the MPC-Ex control racks will be via fiber optic cables.

Cooling for the MPC-Ex will be accomplished using the PHENIX dry air system, which is already providing cooling for the MPC detectors.

In order to accommodate the MPC-Ex, minor modifications to existing equipment is required as follows:

1. The "bellows spreader" which prevents lateral and twisting movement of the bellows in the south Muon Magnet (MMS) (while allowing unimpeded longitudinal movement) will be removed and replaced with a new design which has a smaller radial footprint to allow maximization of detector coverage. This new design is referred to as an "anti-squirm" device to more accurately describe its function. (Note: there is no bellows spreader in the north Muon Magnet [MMN], and as such no anti-squirm device is required in the north magnet.
2. Light collection boxes for the existing MPC's will be moved to the MuID station 1 front end electronics plate (FEE plate) on both north and south detector stations. MuID cables and components on the FEE plate will be relocated / rerouted as necessary to accommodate the light collection boxes.
3. MPC Fiber optic extensions and adapters will be fabricated to allow the light box relocations.
4. Other minor modifications on the side panels of the MMS and MMN to accommodate mounting of MPC-Ex Front End modules will be undertaken as necessary.

Mounting clips are designed to attach to the walls of the MMS and MMN piston cavities to precisely locate the MPC-Ex in the piston holes. Mating mounting tabs are designed for the multiple purposes of aligning and attaching the 2 halves of the detectors to each other around the beam pipe, guiding the insertion of the MPC-Ex detector into the piston holes and precisely positioning the MPC-Ex's in the piston holes.

Installation of the MPC-Ex detectors will require scaffolding, a custom designed insertion/installation tool, and a rigging fixture to lift the upper and lower halves onto the insertion/installation tool.

Assembly Procedures

Micromodule Assembly

Using the micromodule gluing fixture:

1. Lay the ceramic sheet on a clean flat granite table
2. apply appropriately sized kapton tape to the table precisely around the edges of the ceramic sheet to define the gluing surface.
3. apply glue to the ceramic sheet and squeegee to achieve precise thickness
4. lay the silicon sensor sheet on the table and similarly mask and apply glue to the sensor, except on the end where the wire bonding pads are, place the tape over the bonding pads to prevent adhesive from sticking to the pads.
5. position the ceramic sheet in the vacuum gluing fixture base then turn on vacuum to hold part in place
6. place the silicon sensor on the glue laden ceramic sheet, leaving the tape on the wire bond pads and carefully positioning the sensor to align precisely with the ceramic.
7. place the SVX-4 readout card on the silicon sheet on the glue carefully positioning the card to align precisely with the sensor and ceramic.
8. position the slotted micromodule glue fixture side lock on the base and slide it to align the SVX-4 board to the ceramic and sensor sheets, then lock it in position with the thumb screws (finger tight only)
9. Place the gluing fixture weight distributor top on the readout card being careful not to shift the stack.
10. Place 2 20-lb bricks on top of weight distributor gluing fixture top cap).
11. Let sit for 30 minutes, then loosen and remove slotted side lock.
12. Carefully peel the kapton tape off the sensor wire bonding pads.
13. Let the weighted assembly sit for at least 8 hours to allow adhesive to completely set.
14. Remove micromodule from gluing fixture.
15. Inspect for imperfections in stack and/or gluing
16. Send micromodule with vacuum base to instrumentation for wirebonding.
17. Acceptance test

Carrier Board/Tungsten Lamination Assembly

1. Place tungsten plate in laminating fixture on flat granite table
2. Apply double-sided thermal conductive adhesive tape to entire upper surface of tungsten plate
3. Peel off double-sided tape backing and make sure adhesive is distributed to all edges
4. Carefully position carrier board on adhesive covered side of tungsten plate

5. Place 1/4 inch (minimum) anti-static foam on top of carrier board, then place a 1 inch thick steel plate at least large enough to cover the entire area of the the carrier board. (~40 lbs weight)
6. Let stand for at least 1 hour for adhesive to set.
7. Inspect for imperfections in lamination
8. Acceptance test

MPC-Ex Detector Final Assembly

Assemble Upper and Lower halves of MPC-Ex in accordance with MPC-Ex Assembly drawing (drawing # 105-0219-119 attached). (worker planned work).

MPC-Ex Detector Installation

(Note: Scaffolding for installation of MPC-Ex was designed and installed for Muon Tracker work in previous and current shutdowns. Design and installation including all appropriate approval paperwork is provided in the current work permit # DRL-2014-10/SS-2013-___ Muon Tracker Station 1 North & South Maintenance and Repair.)

Removal of the Run 14 Partial Installation

The partial detector MPC-Ex installed for an engineering run during Run 14 will be uninstalled and removed by reversing the installation sequence described below for the 2 full stations of the detector. Although only partially instrumented, the partial detector is geometrically the same as the full detector. After MPC-Ex run 14 partial installation has been removed, disassemble the station 1 scaffolding in accordance with WP #DRL-2014-10 move the CM south to open station 1 north in accordance with standard PHENIX procedure PP-2.5.5.1-01, then install the station 1 scaffolding in north station 1.

MPC-Ex North Station

1. Affix temporary beampipe support to beampipe in station 1
2. Remove existing beampipe support
3. Remove and relocate MPC light collection boxes
4. Install fiber extensions using fabricated fiber connectors and holders provided
5. Drill and tap mounting holes for MPC-Ex mounting clips
6. Install MPC-Ex insertion/installation tool
7. Install mounting clips

8. Using MPC-Ex lifting fixture, install upper and lower MPC-Ex detector halves on insertion/installation device with mount mounting tabs
9. Install MPC-Ex into piston hole.
10. Install front end module(s) on magnet sides.
11. Route cables, fibers and cooling lines as necessary
12. Test and commission partial new detector
13. Remove station 1 scaffolding
14. restore CM to run position in accordance with PHENIX Procedure PP-2.5.5.1-01

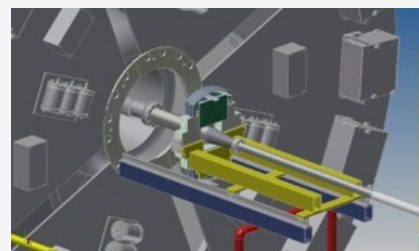
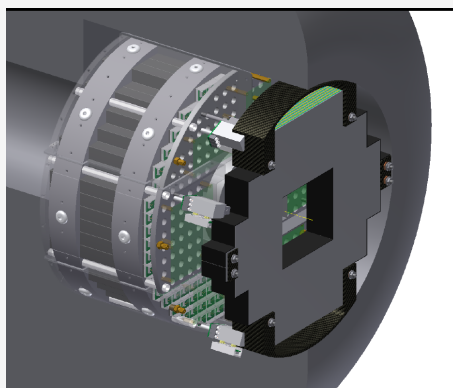
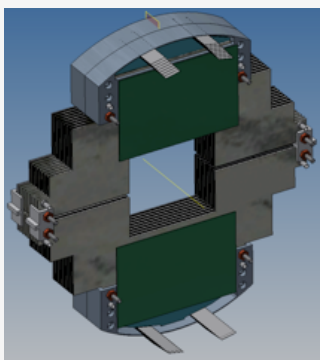
MPC-Ex South Station

1. Affix temporary beampipe support to beampipe in station 1
2. Remove existing "bellows spreader"
3. Install new anti-squirm device
4. Remove and relocate MPC light collection boxes
5. Install fiber extensions using fabricated fiber connectors and holders provided
6. Drill and tap mounting holes for MPC-Ex mounting clips
7. Install MPC-Ex insertion/installation tool
8. Install mounting clips
9. Using MPC-Ex lifting fixture, install upper and lower MPC-Ex detector halves on insertion/installation device with mount mounting tabs
10. Install MPC-Ex into piston hole.
11. Install front end module(s) on magnet sides.
12. Route cables, fibers and cooling lines as necessary
13. Test and commission partial new detector
14. Remove station 1 scaffolding
15. restore MMS to run position in accordance with PHENIX procedure PP-2.5.5.1-01

Closeout

After installation is complete, document and record any lessons learned in this initial installation. Sign and close out the MPC-Ex work permit and the Muon Tracker Station 1 south work permit (for scaffold use).

MPC-Ex Assembly and Installation Plan



June - November,
2014

Don Lynch

Current Plan for Full MPC-Ex Installation for Run 15

For Run-15 the goal will be to install complete MPC-EX detectors in both the north and south muon magnet piston. All layers will be fully populated with sensors and electronics and both stations will be fully operational .

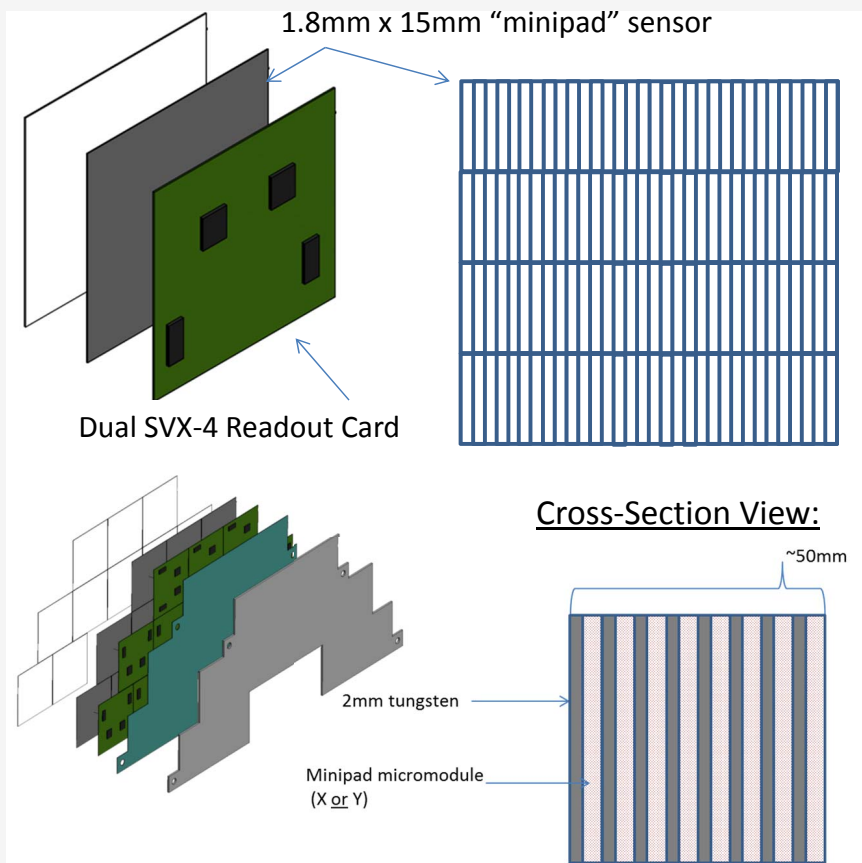
Subassemblies:

ROC Micro-modules: There are normally 12 of these for each half layer, 392 total for both MPC-Ex's. All will be included in the Run 15 installation. Each ROC micro-module is assembled as a PC board, a silicon sensor module and a ceramic sheet which are all glued together in a gluing fixture. The sensor is then sent to instrumentation to have its sensor leads wire bonded to the electrical distribution pads on the PC board.

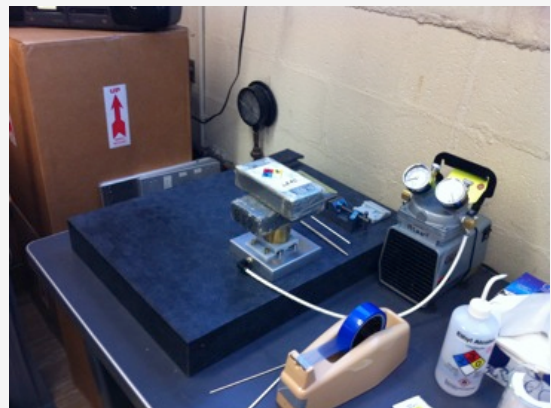
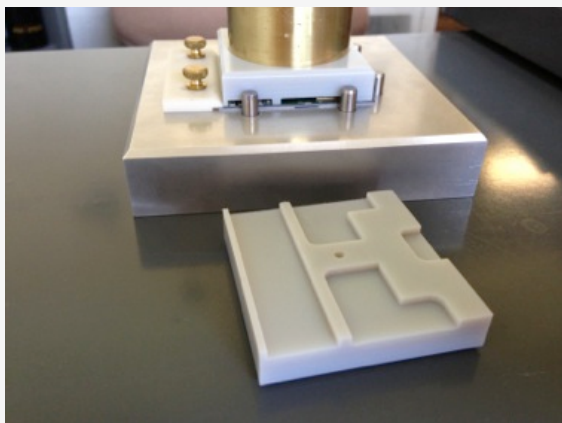
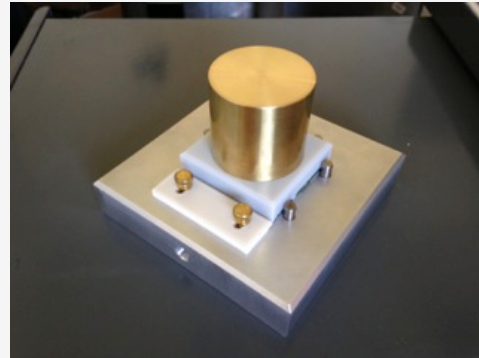
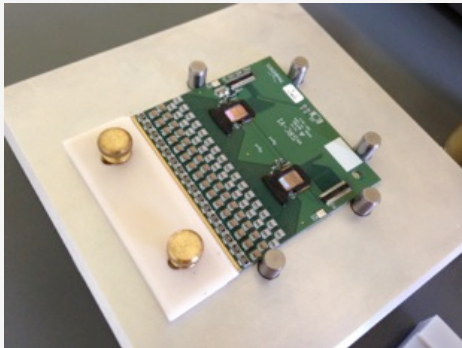
Carrier boards: Produced outside.

Tungsten/Carrier board modules: The carrier boards are fastened to 2mm thick tungsten plates at PHYSICS using a positioning fixture and double sided adhesive.

Upper and Lower, North and South Detector segment assemblies are then mechanically assembled. Each is made of 8 T/C modules and a single Delrin cover plate (design identical to tungsten plates). The space between tungsten plates is made uniform by threaded spacers and the entire assembly is held together with threaded rods on which the spacers ride. The top and bottom modules have their upper and lower ends protected by a Delrin "cradle" which provides extra support, protection for the signal cables and support for the power supply/PC interface boards.

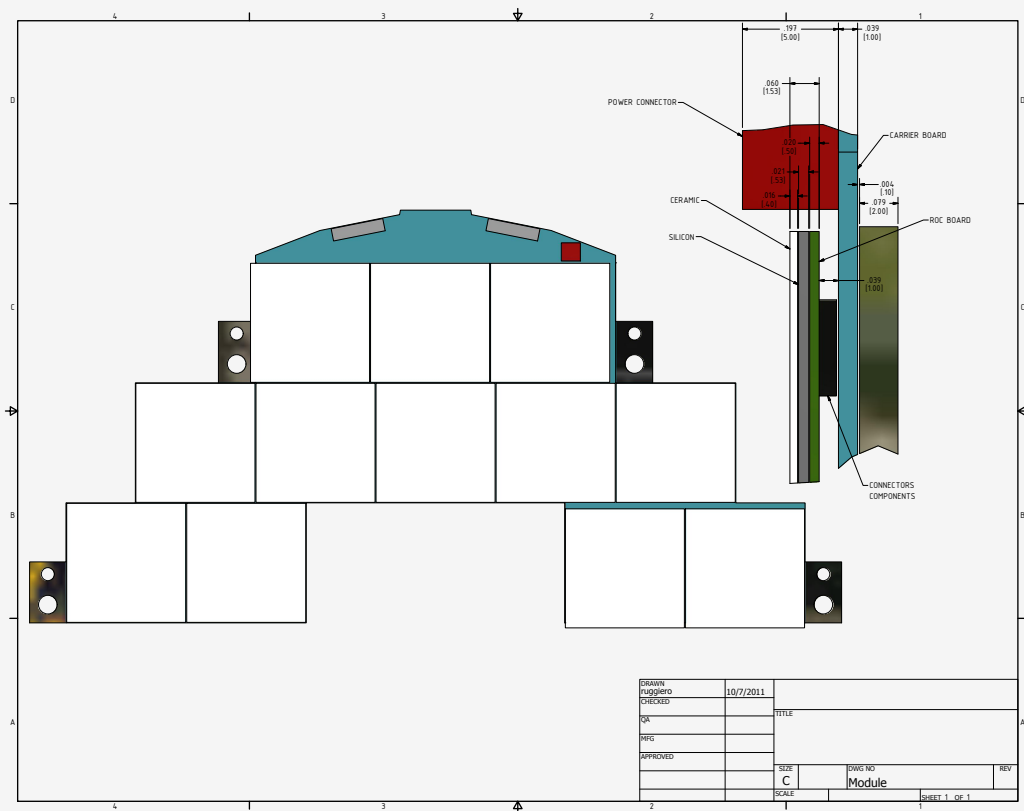


Micromodule layout

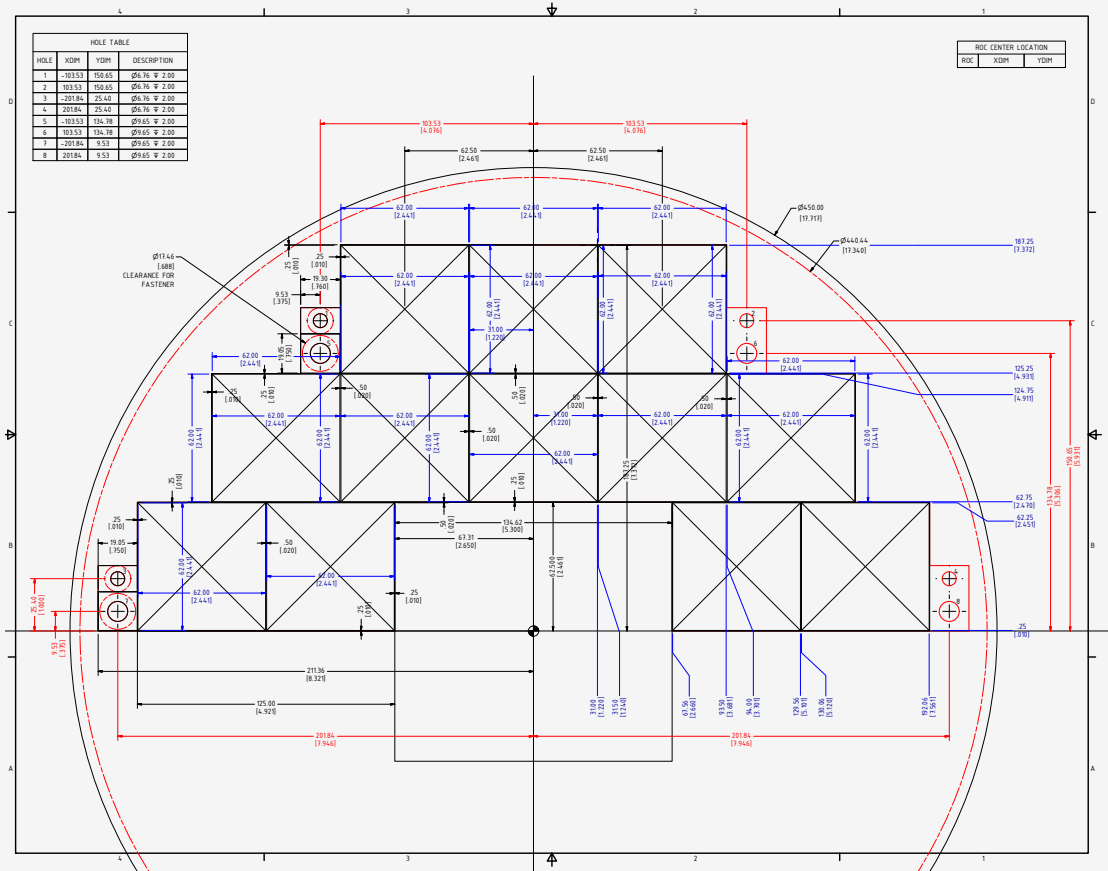


Micromodule Gluing tool micromodule parts and glued assembly currently in production

Single Layer Design



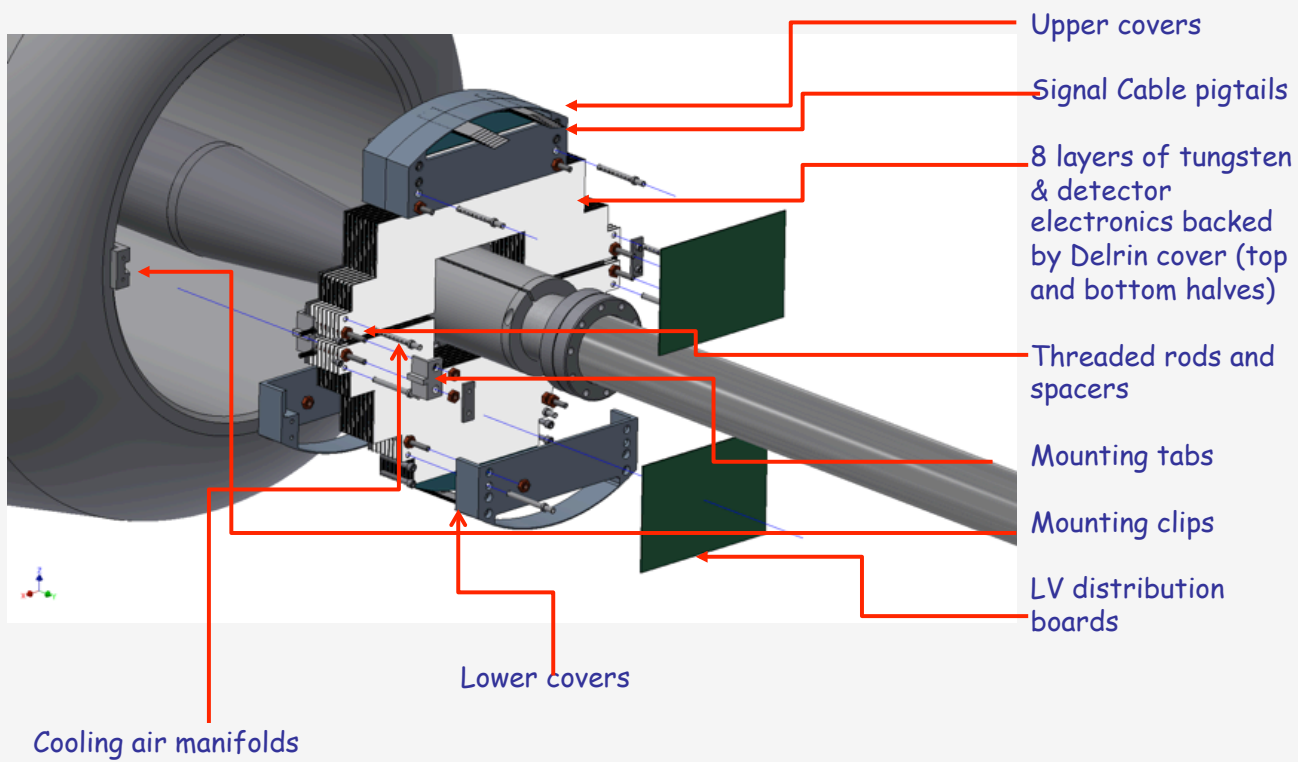
ROC CENTER LOCATION		
ROC	XDIM	YDIM

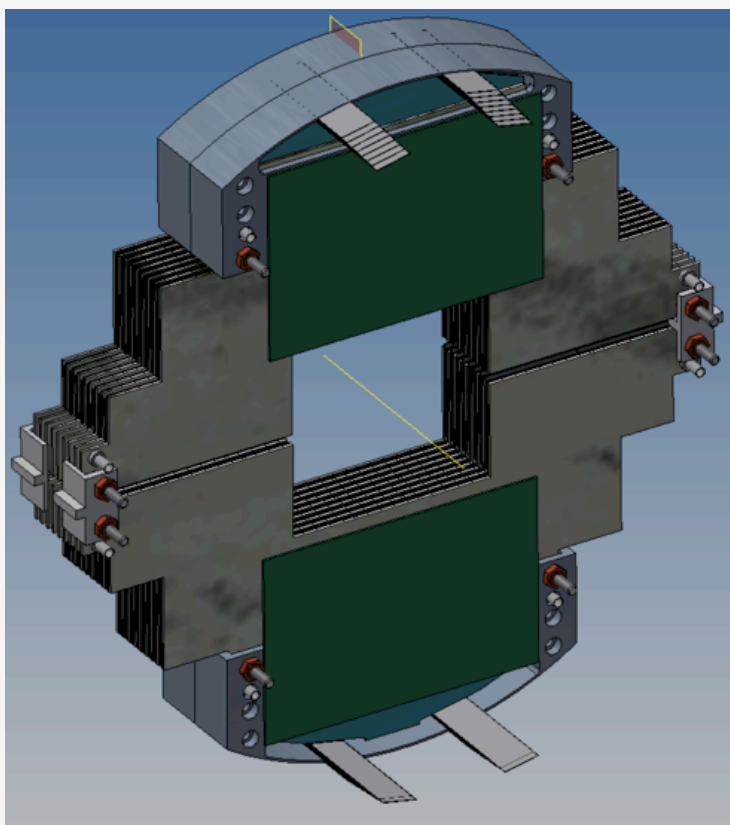


Sensor Layout Alternating X-Y Orientation

Carrier Board Layout

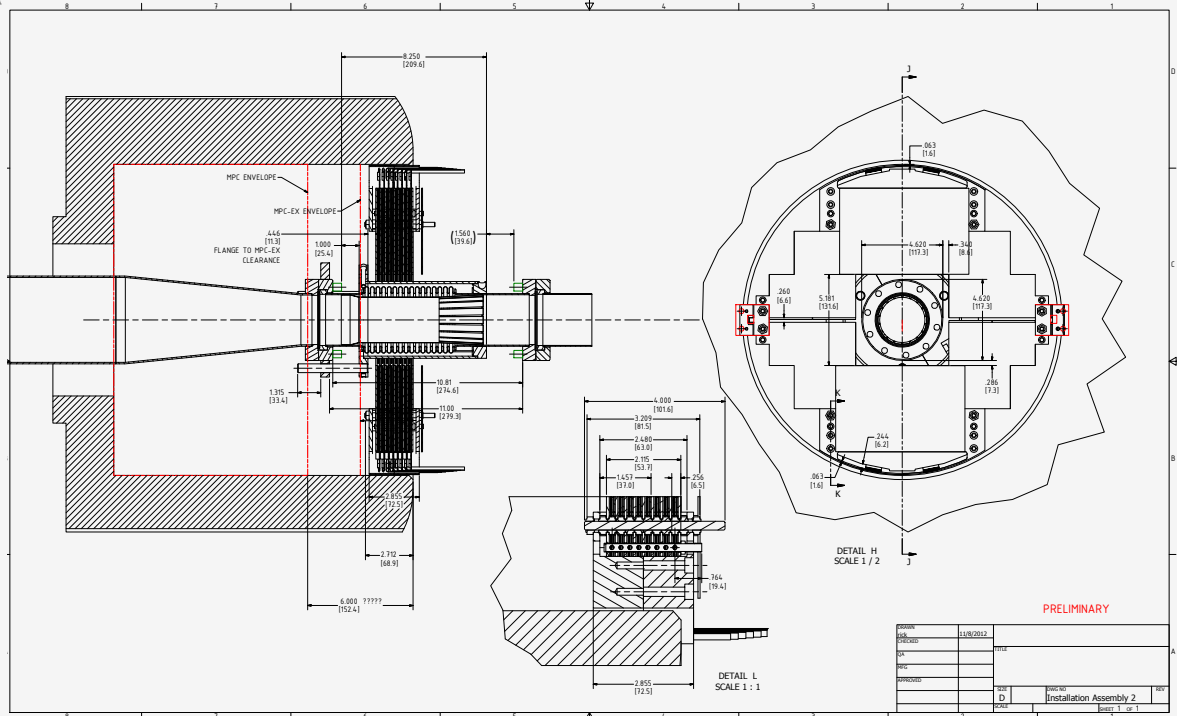
MPC-Ex Exploded view





MPC-Ex Full Model

Run 14 Partial installation will include $\frac{1}{4}$ of the electronics and all of the tungsten for the south detector. Edge closures not shown.

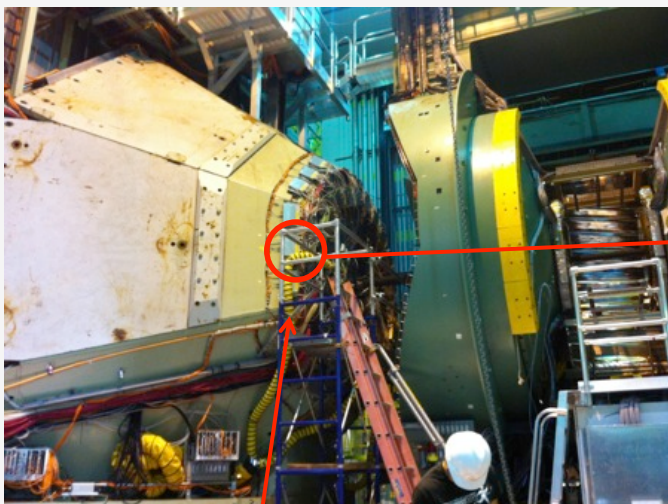


Installed Layout

MPC-Ex Site Preparation



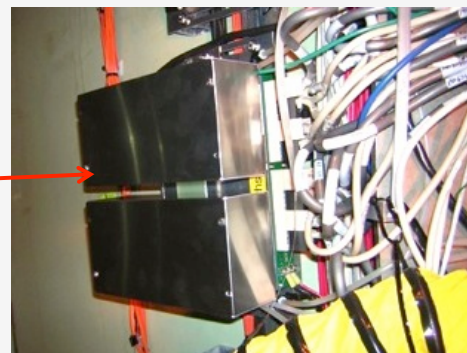
Insertion/installation tool
installed with beampipe
protection



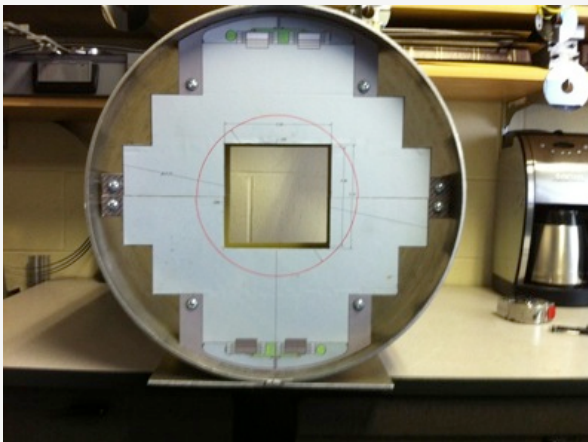
Scaffolding in place from MuTr maintenance

MPC Flat cables replaced with round cables (Done last year)

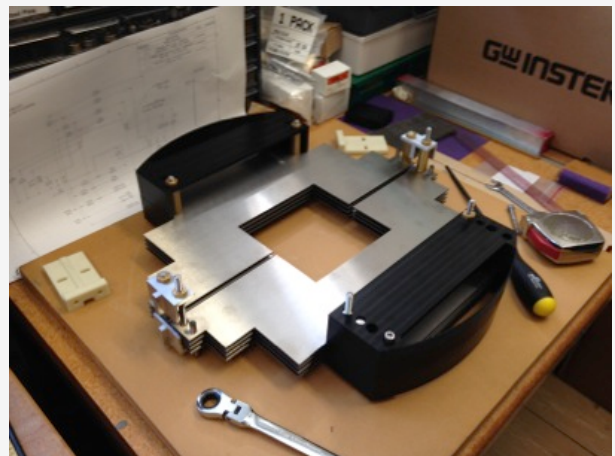
MPC Cables rerouted



Front end electronics enclosures mounted on existing MuTrigger front end electronics boxes.

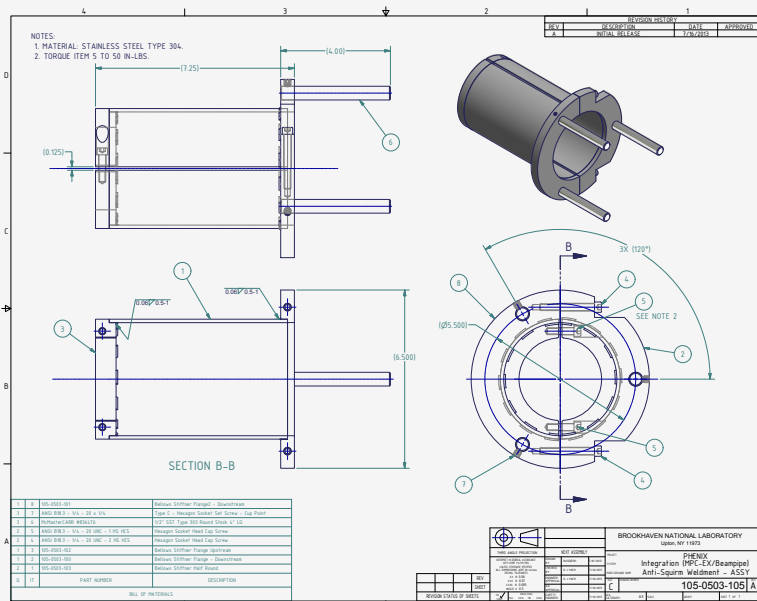


MPC-Ex mockup to be used for cable and utilities routing plans



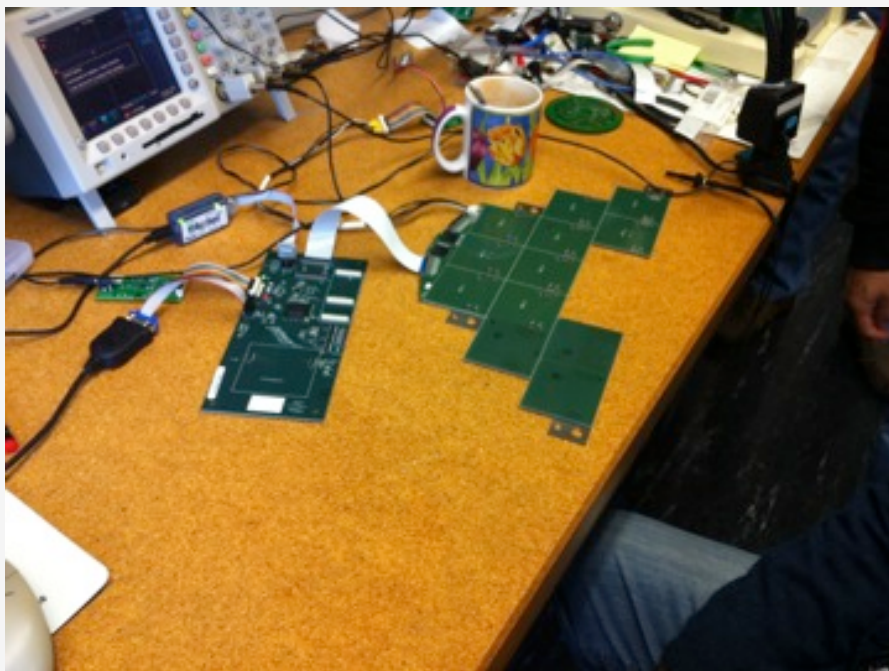
Tungsten plate test fitup





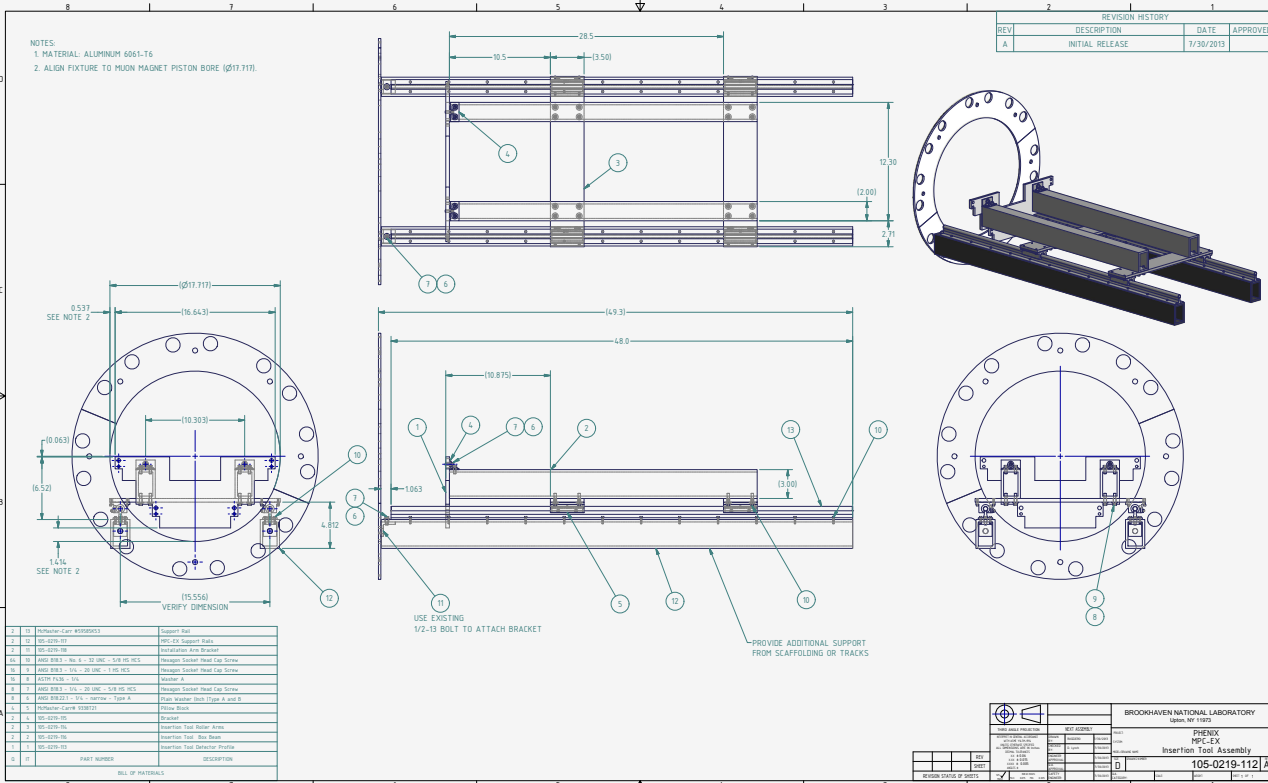
Anti-squirm replaces existing "bellows spreader"





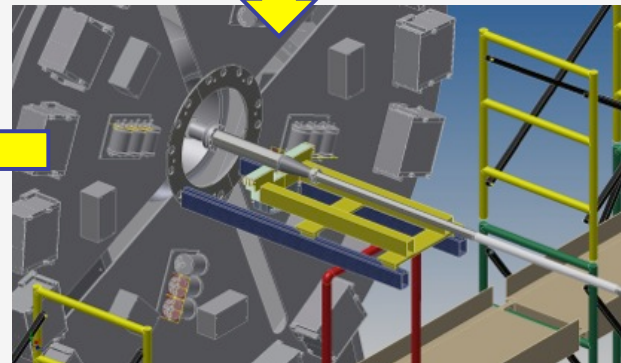
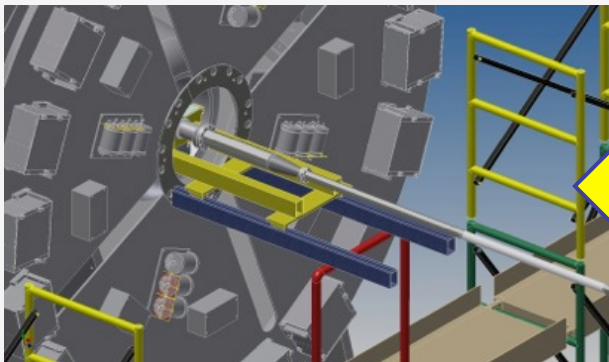
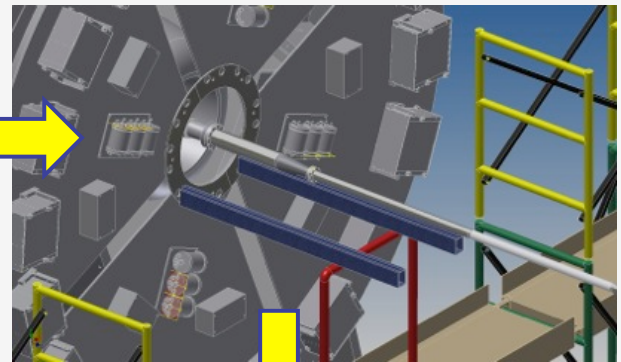
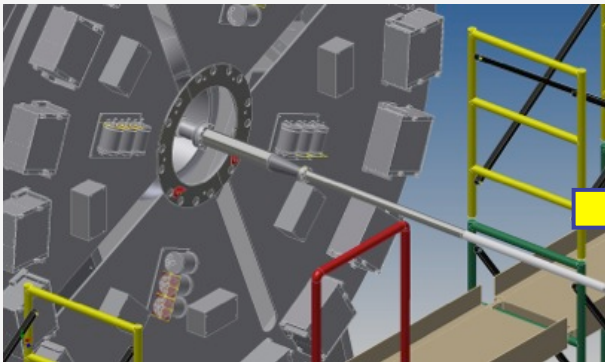
1st test of front end module board with laminated tungsten/carrier board & partial micromodules

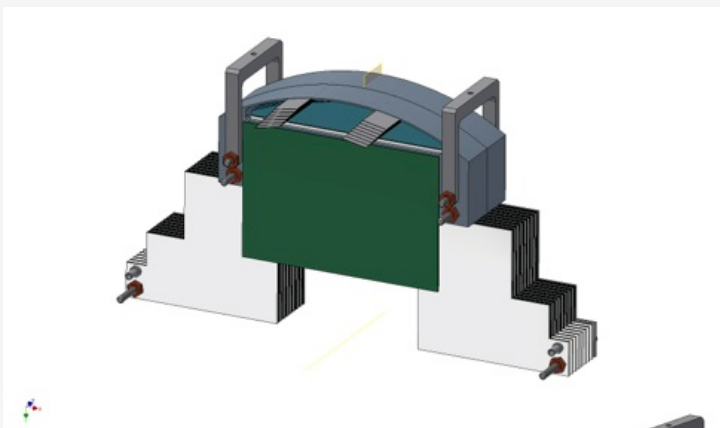
INSTALLATION



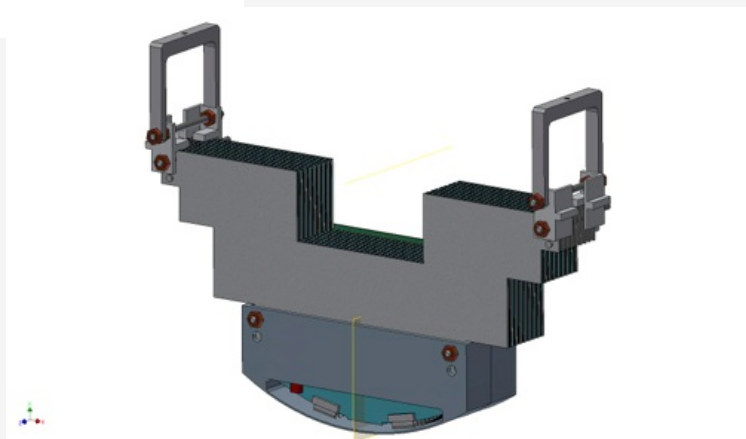
MPC-Ex Insertion/Installation Tool

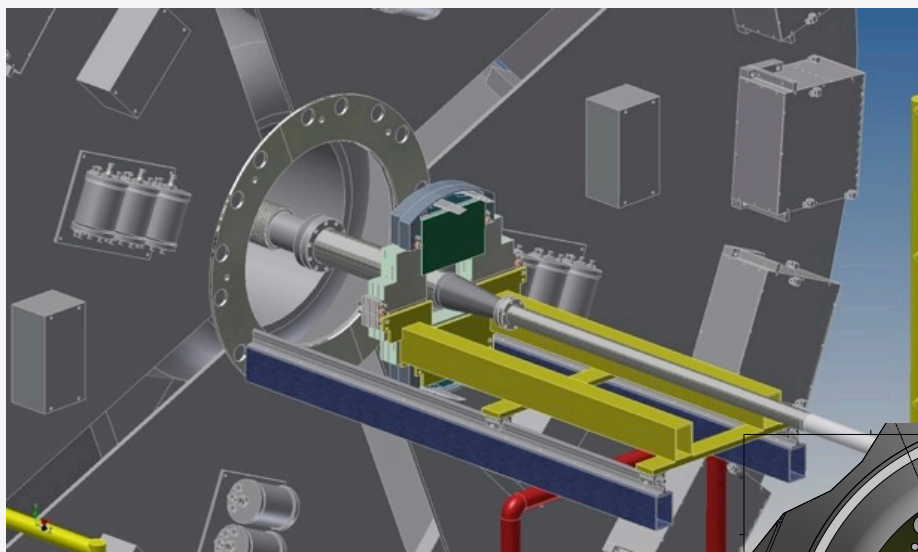
Setting Up for Installation



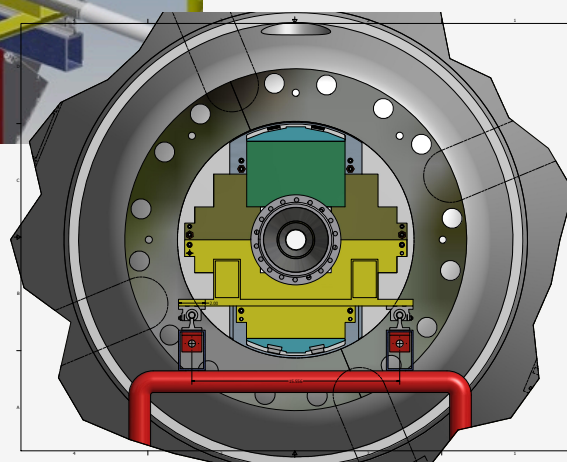


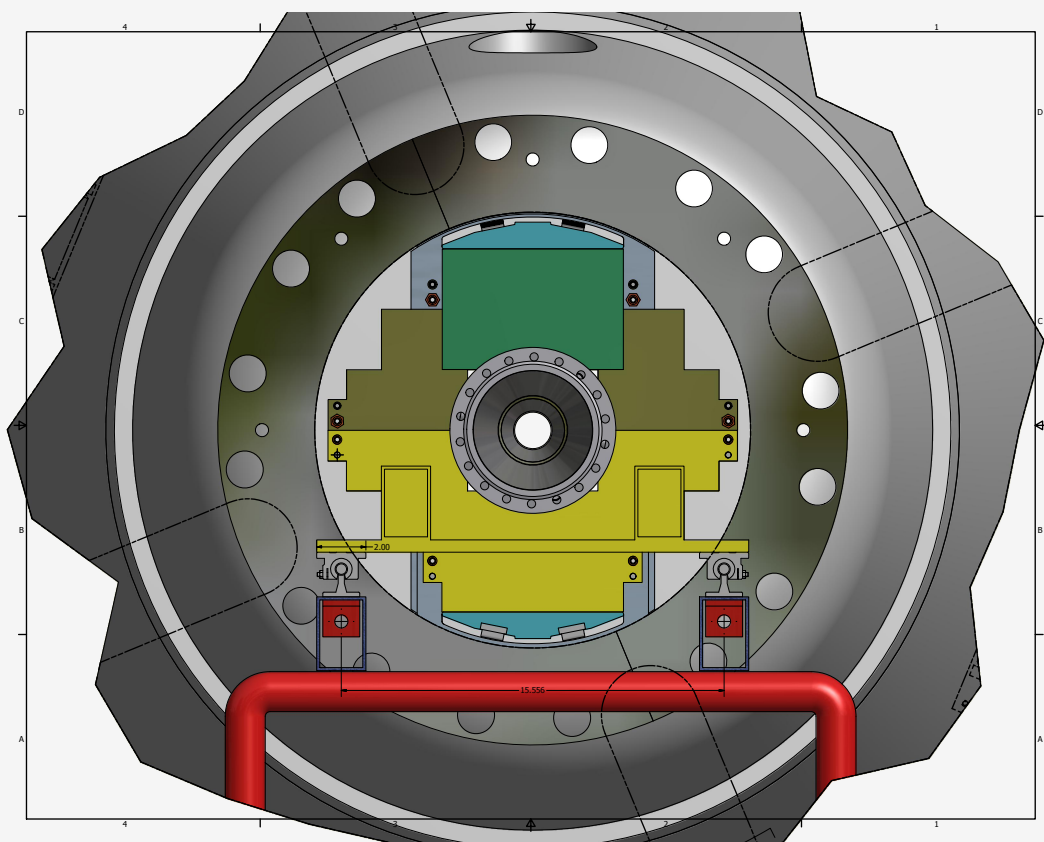
Upper and lower MPC-Ex halves with lifting tools for positioning halves around beampipe on insertion/lifting tool





MPC-Ex installed on insertion/
installation tool ready for
insertion/installation





MPC-EX

Power Distribution



Power Requirements (One Side)

- Detector split into upper and lower portions with 8 SVX boards each.
- Each portion monitored and controlled by one 8 channel MPC-EX LV Distribution Controller.
- Each channel (SVX board) requires:
 1. 2.5V @ 2A Analog
 2. 2.5V @ 1A Digital
 3. 1.5V @ 0.2A Digital
 4. 3.3V @ 0.2A Config

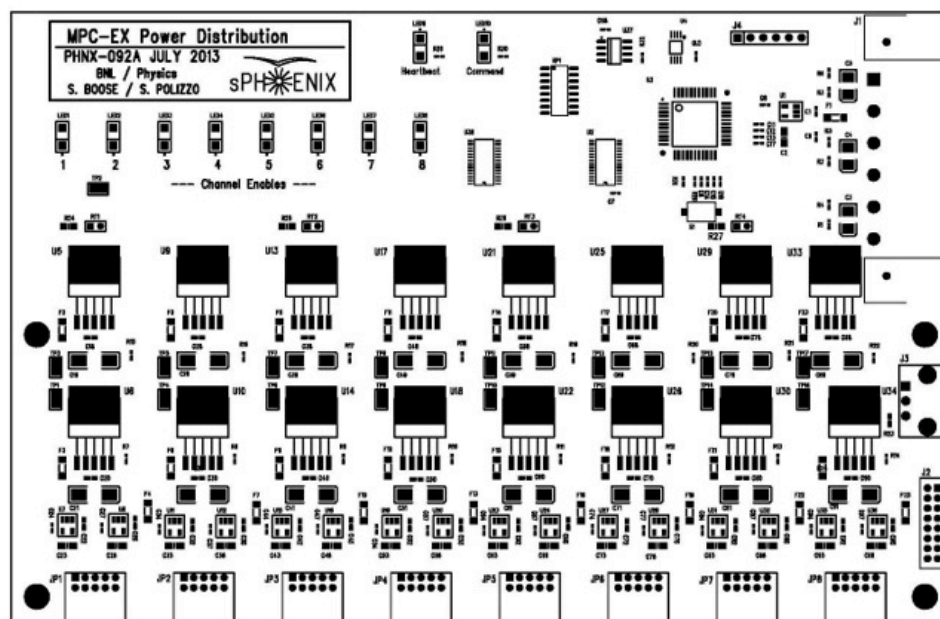


MPC-EX LV Distribution Board

- Fed by LV and bias from rack mounted power supplies.
- All channels fused by polyswitches.
- 8 channels of bias passively routed to SVX boards.
- Computer controlled via RS485 link from PC:
 1. Individual channel LV enables.
 2. Temperature monitoring of LV Dist and SVX boards.
 3. Voltage monitoring of higher current outputs.



MPC-EX LV Distribution Board



LV Input

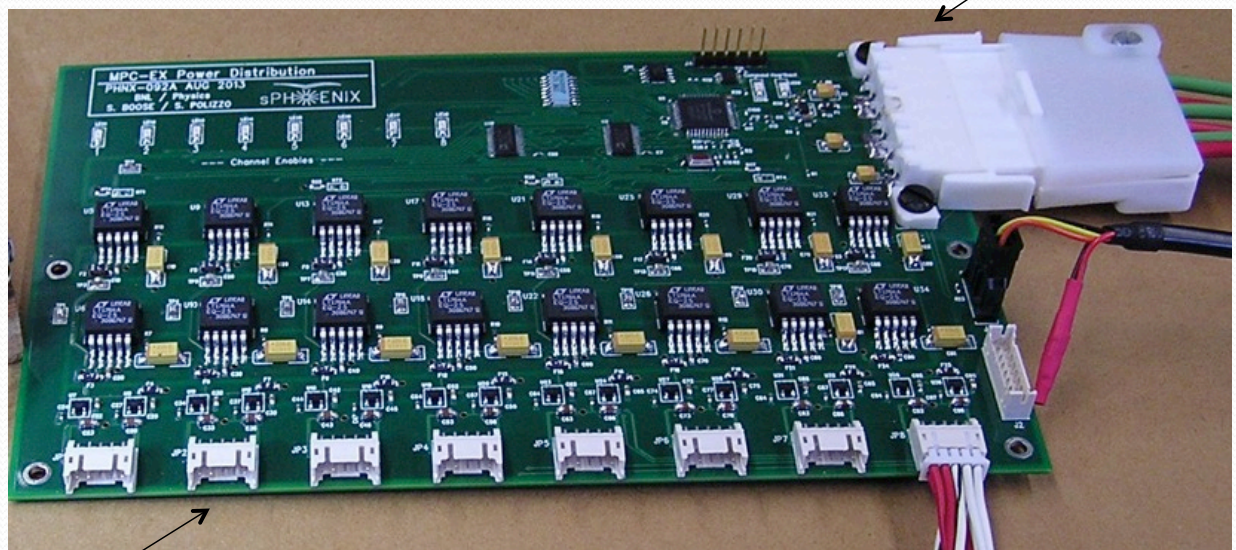
RS485

Bias Input

Outputs



MPC-EX LV Distribution Board



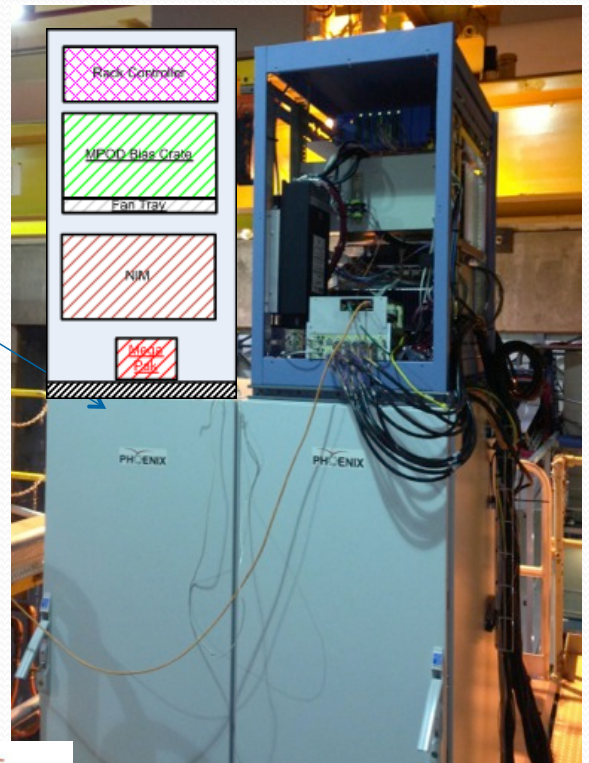
TE Mate-N-Lok

JST PHD Connector



MPC-EX Racks

- Same 1m x 1m type as MPC with 31" of vertical rack space.
- Mounted on top of SMT₅ and NMT₅ racks.
- Contain low voltage, NIM crate and bias.

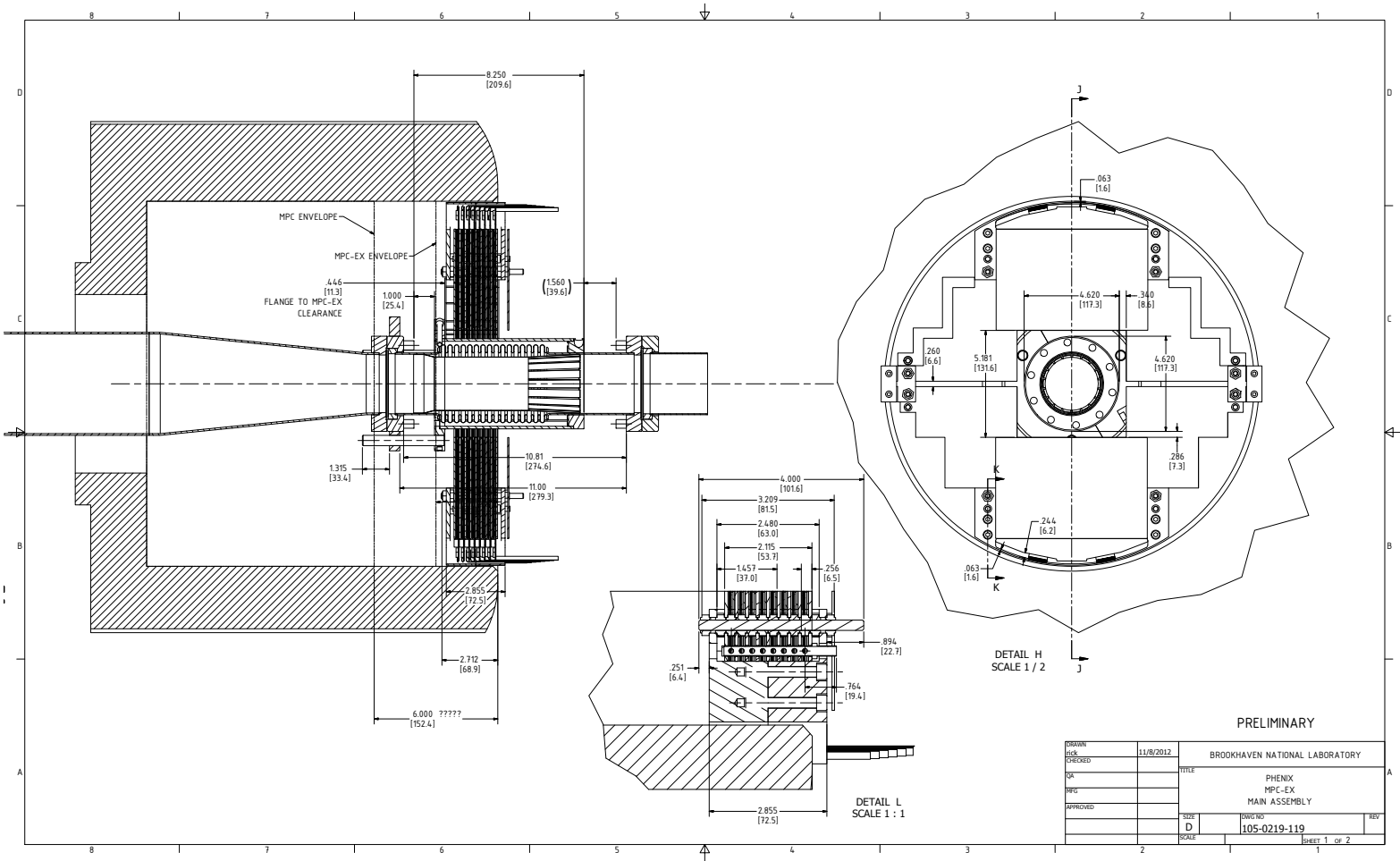


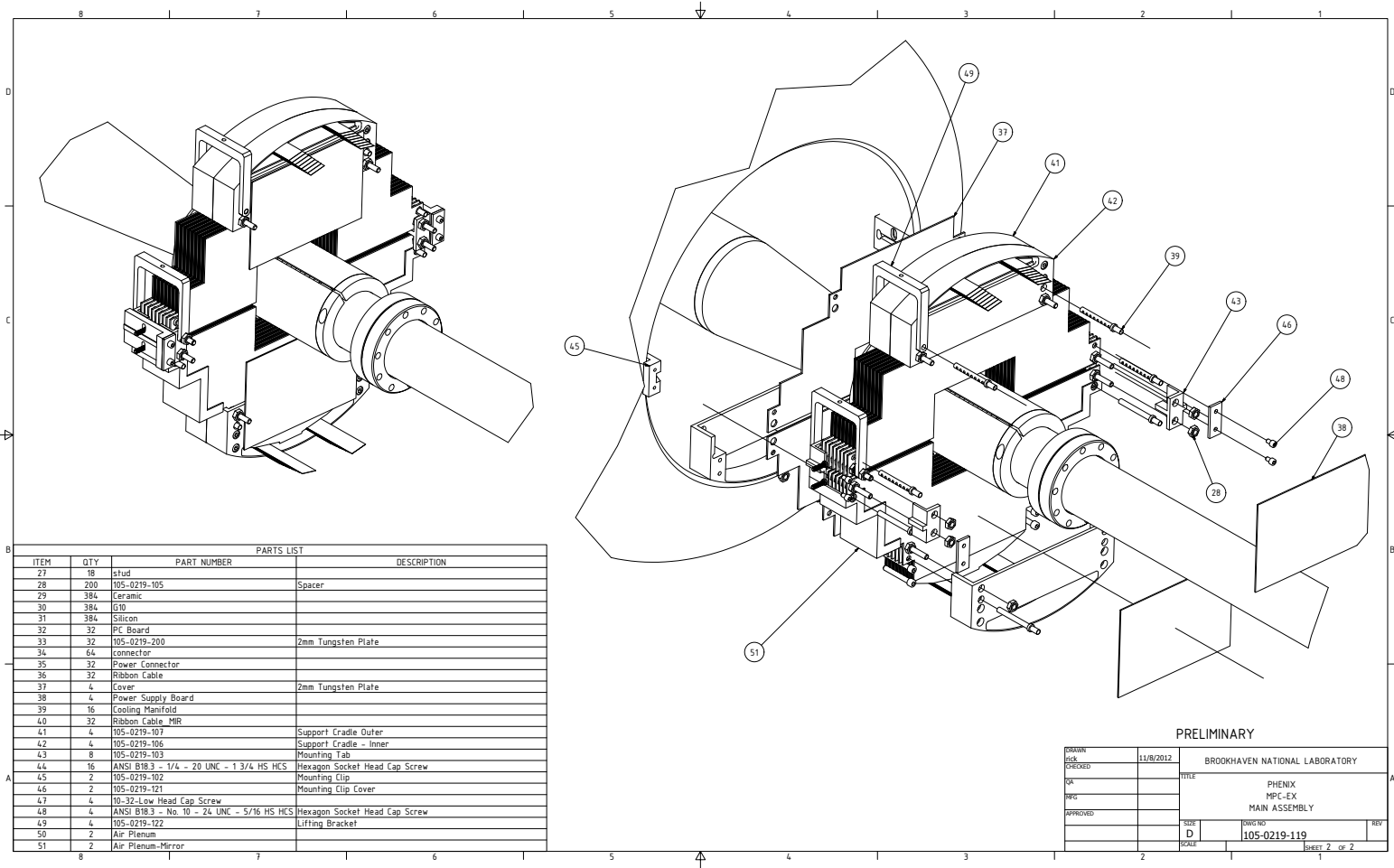
Cables, Connectors and Fuses

- Low voltage:
 - Alpha 65205 AWG #12 fused at the source for 15A.
 - TE 640583-3 Mate-N-Lok LV Distribution Board input connector.
 - JST PHD connector, 250V rated, UL94V-o output channel connector, polyfused for 4A or less.
- Bias voltage:
 - AWG #26 300V rated instrumentation cable.
 - JST PHD connector, 250V rated, UL94V-o.

Installation Schedule

Procure & Fabricate parts for MPC-Ex North and South	1/1/2014-6/30/2014
Start of Shutdown Tasks (purge flammable gas, disassemble and stow shield wall, remove collars, move EC to AH, Move MMS south, etc.)	7/14 – 7/25/2014
Install scaffolding in Sta 1 South	7/28/2014
Remove MPC-Ex prototype	7/28-8/1/2014
MuTr Sta 1 South troubleshooting and repairs	7/28-8/1/2014
Maint. & Repairs for MPC South, BBC South, RPC1 South1	7/28-8/1/2014
Assemble & test MPC-Ex North, ready for installation	8/1-9/5/2014
Remove scaffolding from sta 1 south, Move CM South	8/4-8/5/2014
Install scaffolding in Sta 1 North	8/6-8/8/2014
MuTr Sta 1 & Sta. North troubleshooting and repairs	8/11-9/5/2014
Prep MPC-Ex North installation area	8/11-9/5/2014
Install new MPC-Ex North	9/8-9/26/2014
Assemble & test MPC-Ex South, ready for installation	9/2-10/3/2014
Remove Sta 1 N scaffolds, Move CM North, Install scaffolding in Sta 1 S	9/29-10/3/2014
Install MPC-Ex South	10/6-10/24/2014
End of Shutdown Tasks (Move MS north, roll in EC , install collars, remove 10 ton cart, plates and manlifts, build shield wall, etc.)	10/27-11/26/2014
MPC-Ex Pre-Run Commissioning	10/27-12/31/2014
Pink/White/Blue Sheets	12/1-12/19/2014
Start Flammable gas flow	????
Close shield wall, install radiation interlocks and prepare for run 14	12/31/2014
Start run 15	1/2/2015





PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
27	18	stud	
28	200	105-0219-105	Spacer
29	384	Ceramic	
30	384	SiO	
31	384	Silicon	
32	32	PC Board	
33	32	105-0219-200	2mm Tungsten Plate
34	64	connector	
35	32	Power Connector	
36	32	Ribbon Cable	
37	4	Cover	2mm Tungsten Plate
38	4	Power Supply Board	
39	16	Cooling Manifold	
40	32	Ribbon Cable MIR	
41	4	105-0219-107	Support Cradle Outer
42	4	105-0219-106	Support Cradle - Inner
43	8	105-0219-103	Mounting Tab
44	16	ANSI B18.3 - 1/4 - 20 UNC - 1 3/4 HS HCS	Hexagon Socket Head Cap Screw
45	2	105-0219-102	Mounting Clip
46	2	105-0219-121	Mounting Clip Cover
47	6	10-32-Low Head Cap Screw	
48	4	ANSI B18.3 - No. 10 - 24 UNC - 5/16 HS HCS	Hexagon Socket Head Cap Screw
49	4	105-0219-122	Lifting Bracket
50	2	Air Plenum	
51	2	Air Plenum-Mirror	

PRELIMINARY

DRAWN	11/8/2012	BROOKHAVEN NATIONAL LABORATORY	
CHECKED			
OR		TITLE	
DATE		PHENIX	
APPROVED		MPC-EX	
		MAIN ASSEMBLY	
		DATE	REV
		D	105-0219-119
		SCALE	SHEET 2 OF 2